

CLAIMS

1. Method of obtaining an optical lens from a polymerizable material, which method uses a mold (1) that is formed of two facing and spaced shells (2, 3) and an annular seal (4) comprising means (10, 11) for cooperating with the periphery of said shells (2, 3) to define a molding cavity, said seal (4) being adapted to be compressed elastically when said shells (2, 3) are moved toward each other, which method comprises a step of filling said molding cavity with said polymerizable material, a step of polymerizing the material filling the molding cavity, a step of applying an external mechanical force to move said shells toward each other, and a step of releasing said force, and which method is characterized in that a filling hole (19) is provided in said annular seal (4), away from said means (10, 11) for cooperating with the periphery of the shells (2, 3), in that during said filling stage said material is introduced into the cavity through said filling hole (19), and in that said material is introduced after said step of applying a mechanical external force to move said shells toward each other and before said step of releasing said force.

2. Method according to claim 1, characterized in that a plug (5) is provided for plugging each hole (19) in said seal (4) and said filling step comprises, after introducing said material and before said step of releasing said force, a step of plugging each of said holes (19) with one of said plugs (5).

3. Method according to claim 2, characterized in that the only hole in said annular seal (4) is said filling hole (19).

4. Method according to claim 3, characterized in that said filling step is effected with said mold (1) placed vertically with said filling hole (19) situated at the top of said seal (4).

5. Method according to claim 4, characterized in that said filling hole comprises a first section (21) and a second section (22), the first section (21) extending between a first end opening into said molding cavity and a second end at which it is joined to a first end of said second section (22), in that a plug (5) is provided for plugging said filling hole and comprises a body (25) adapted to fit tightly into said first section (21) of the filling hole (19) to plug it and to define with said second section (22) of the filling hole (19) a chamber (26) around said body (25) of the plug (5), and in that said cavity and said first section (21) of the hole (19) are filled during said step of introducing the polymerizable material into the cavity.

6. Method according to claim 5, characterized in that said molding cavity and said first section (21) of the filling hole (19) are filled during said filling step to the level of the junction between the first section (21) and the second section (22).

7. Method according to claim 6, characterized in that the volume of said chamber (26) around the body (25) of the plug (5) is greater than the volume of said first section (21) of the filling hole (19).

8. Method according to any of claims 5 to 7, characterized in that said filling hole (19) further comprises a third section (23) that extends between a first end at which it is joined to the second end of the second section (22) and a second end that opens to the exterior of said seal (4), and in that said plug (5) comprises a head (24) adapted to fit tightly into said third section (23) of the filling hole (19) to plug it, so that said chamber (26) is then entirely closed.

9. Method according to any of claims 1 to 8, characterized in that a boss (20) is provided around said filling hole (19) and projects relative to the lateral

surface (15) of the seal (4).

10. Method according to any of claims 1 to 9, characterized in that said filling hole (19) is oriented in a radial direction.

5 11. Method according to any of claims 1 to 10, characterized in that said filling hole (19) is halfway or substantially halfway between said means (10, 11) adapted to cooperate with a first shell (2) and with the second shell (3), respectively.

10 12. Method according to any of claims 1 to 11, characterized in that said step of applying a mechanical external force to move said shells toward each other is adapted to move said shells toward each other until a predetermined force is reached.

15 13. Method according to claim 12, characterized in that said force to move said shells toward each other is produced by an actuator (37) connected to a control center (40).

20 14. Method according to either claim 12 or claim 13, characterized in that, during said step of applying a force to move said shells toward each other, said force is applied to said shells by way of respective sleeves (34, 35) having a diameter slightly less than that of said shells (2, 3).

25 15. Method according to any of claims 1 to 14, characterized in that a unit (31) is provided for receiving said mold (1) and in that said step of applying a force to move said shells toward each other and said step of releasing said force are effected by means of said  
30 receiving unit (31).

16. Method according to claim 15, characterized in that centering means (32) and angular positioning means (33) are provided in said unit (31) for receiving the mold (1).

35 17. Method according to claim 16, characterized in

that said centering means comprise two fingers (32) oriented longitudinally and adapted to cooperate with the lateral surface (15) of said seal (4) and said angular positioning means comprise a fork (33) adapted to cooperate with a boss (20) projecting relative to the lateral surface (15) of said seal.

18. Method according to any of claims 15 to 17, characterized in that, for effecting said filling step, there are provided a station (41) for introducing said polymerizable material into the cavity of said mold (1) and a station (42) for plugging said filling hole, said introduction station (41) and said plugging station (42) being disposed side by side, and in that said unit (31) for receiving the mold (1) is movable between a first position in which it is vertically aligned with the plugging station (42) and a second position in which it is vertically aligned with the introduction station (41).

19. Method according to any of claims 1 to 18, characterized in that said step of introducing the polymerizable material is effected by means of a station (41) that comprises a nozzle (48) for introducing said material and a nozzle (49) for aspirating surplus material.

20. Method according to claim 19, characterized in that said nozzle (48) for introducing said material is inclined.

21. Method according to either claim 19 or claim 20, characterized in that the distal end of said nozzle (48) for introducing said material is below the distal end of said aspiration nozzle (49).

22. Method according to any of claims 1 to 21, characterized in that a plug (5) is provided for plugging said filling hole (19) and comprises a blind hole (51) and in that a step of plugging said filling hole with said plug is effected at a plugging station (42) comprising a canula (50) adapted to be engaged in said blind hole (51) of said

plug (5).

23. Method according to claim 22, characterized in that said canula (50) is connected to a vacuum system to hold said plug in place on said canula and said canula (50) is vented to the atmosphere to release said plug (5).

24. Method according to either claim 22 or claim 23, characterized in that said plug (5) is pressed into said filling hole (19) by driving said plugging station (42).

25. Method according to any of claims 1 to 24, characterized in that there is provided a relatively narrow lug (17) projecting relative to the lateral surface (15) of said seal (4) and having a transverse end surface (18) incorporating a predetermined location relative to the remainder of the seal.

26. Method according to claim 25, characterized in that, for effecting said filling step, there are provided a station (41) for introducing said polymerizable material into the cavity of said mold (1) and a station (42) for plugging said filling hole (19), said introduction station (41) and said plugging station (42) being disposed side by side, in that a unit (31) is provided for receiving said mold (1) in a predetermined position and said receiving unit (31) is mobile between a first position in which it is vertically aligned with the plugging station (42) and a second position in which it is vertically aligned with the introduction station (41).

27. Method according to claim 26, characterized in that at least one optical cell (46, 47) is provided for detecting the position of the mold (1) relative to said filling station (41) or said plugging station (42) and in that said unit (31) for receiving the mold is placed in vertical alignment with said filling station (41) or in vertical alignment with said plugging station (42) in conjunction with said optical cell (46, 47).

28. Method according to claim 27, characterized in that respective optical cells (46, 47) are provided for said filling station (41) and said plugging station (42).

29. Annular seal for obtaining an optical lens from a polymerizable material and suitable for use in the method according to any of claims 1 to 28, said seal comprising means (10, 11) for cooperating with the periphery of two facing molding shells (2, 3) to define a molding cavity, adapted to be compressed elastically by a force for moving the shells toward each other that is applied between the means (10, 11) adapted to cooperate with the periphery of a first shell (2) and the means (10, 11) adapted to cooperate with the periphery of the second shell (3), which seal is characterized in that it comprises:

- a filling hole (19) away from said means (10, 11) and adapted to cooperate with the periphery of the shells (2, 3), the filling hole comprising a first section (21) and a second section (22), the first section (21) extending between a first end opening into said molding cavity and a second end by which it is joined to a first end of the second section (22), and

- a plug (5) comprising a body (25) adapted to fit tightly into said first section (21) of the filling hole (19) to plug it and to define with said second section (22) of the filling hole (19) a chamber (26) around said body (25) of the plug.

30. Seal according to claim 29, characterized in that the only hole in it is said filling hole (19).

31. Seal according to either claim 29 or claim 30, characterized in that the volume of said chamber (26) around the body (25) of the plug (5) is greater than the volume of said first section (21) of the filling hole (19).

32. Seal according to any of claims 29 to 31, characterized in that said filling hole (19) further

comprises a third section (23) that extends between a first end at which it is joined to the second end of the second section (22) and a second end that opens to the exterior of said seal (4) and in that said plug (5) comprises a head (24) adapted to fit tightly into said third section (23) of the filling hole (19) to plug it so that said chamber (26) is then entirely closed.

33. Seal according to any of claims 29 to 32, characterized in that it comprises a boss (20) around said filling hole (19) and projecting relative to its lateral surface (15).

34. Seal according to any of claims 29 to 33, characterized in that said filling hole (19) is oriented in a radial direction.

35. Seal according to any of claims 29 to 34, characterized in that said filling hole (19) is halfway or substantially halfway between said means (10, 11) adapted to cooperate with a first shell (2) and with the second shell (3), respectively.

36. Seal according to any of claims 29 to 35, characterized in that it comprises a relatively narrow lug (17) projecting relative to the lateral surface (15) of said seal (4) and having a transverse edge surface (18) at a predetermined location relative to the remainder of the seal.

37. Seal according to claim 36, characterized in that the angular distance between said filling hole (19) and said relatively narrow lug (17) is such that said lug (17) is visible above said seal (14) when said mold (1) is placed with said filling hole (19) at the top.

38. Seal according to any of claims 29 to 37, characterized in that said plug (5) for plugging said filling hole (19) comprises a blind hole (51) having its closed end inside said body (25).

39. Seal according to any of claims 29 to 38,

characterized in that it comprises a belt (8) to the inside of which is joined a bead (9) narrower than said belt (8), said bead having a dovetail-shaped cross section whose narrower side is that by which said bead (9) is joined to said belt (8), so that there exists on either side of said bead (9) a recess adapted to receive one of said shells (2, 3).

40. Seal according to any of claims 29 to 39, characterized in that said plug (5) and the remainder of said seal (4) are made from the same material.

41. Device for obtaining an optical lens from a polymerizable material and suitable for use in the method according to any of claims 1 to 28, the device comprising a mold (1) formed of two facing and spaced molding shells (2, 3) and an annular seal (4) comprising means (10, 11) for cooperating with the periphery of said shells (2, 3) to define a molding cavity, said seal (4) being adapted to be compressed elastically by a force for moving said shells toward each other, which device (30) comprises means (41, 42) for filling said molding cavity with said polymerizable material and means (34-40) for applying a force for moving said shells (2, 3) toward each other and is characterized in that said seal (4) comprises a filling hole (19) away from said means (10, 11) for cooperating with the periphery of the shells (2, 3), in that said filling means (41, 42) are adapted to introduce said material into the molding cavity through said filling hole (19), and in that said means (34-40) applying a force for moving said shells toward each other are adapted to apply and release said force respectively before and after the use of said filling means (41, 42).

42. Device according to claim 41, characterized in that said seal (4) conforms to any of claims 29 to 40.

43. Device according to either claim 41 or claim 42, characterized in that said means (34-40) for applying a



force for moving said shells (2, 3) toward each other comprise means (37, 40) for moving said shells toward each other until a predetermined force is reached.

5 44. Device according to claim 43, characterized in that said means for applying a force for moving said shells toward each other comprise an actuator (37) connected to a control center (40).

10 45. Device according to any of claims 41 to 44, characterized in that said means for applying a force for moving said shells toward each other comprise, for applying said force to said shell, respective sleeves (34, 35) whose diameter is slightly less than that of said shells (2, 3).

15 46. Device according to any of claims 41 to 45, characterized in that it comprises a unit (31) for receiving said mold (1) provided with said means (34-40) for applying a force for moving said shells toward each other.

20 47. Device according to claim 46, characterized in that said unit (31) for receiving the mold (1) comprises centering means (32) and angular positioning means (33).

25 48. Device according to claim 47, characterized in that said centering means comprise two longitudinally oriented fingers (32) adapted to cooperate with the lateral surface (15) of said seal (4) and said angular positioning means comprise a fork (33) adapted to cooperate with a boss (20) projecting relative to the lateral surface (15) of said seal.

30 49. Device according to any of claims 41 to 48, characterized in that said filling means comprise a station (41) for introducing said polymerizable material into the cavity of said mold (1) and a station (42) for plugging said filling hole, said introduction station (41) and said plugging station (42) being disposed side by side, in that said device (30) comprises a unit (31) for receiving said  
35 mold in a vertical position with said filling hole (19)

situated at the top of said seal (4), and in that said unit (31) for receiving the mold (1) is movable between a first position in which it is vertically aligned with the plugging station (42) and a second position in which it is vertically aligned with the introduction station (41).

50. Device according to claim 49, characterized in that said introduction station (41) comprises a nozzle (48) for introducing said material and a nozzle (49) for aspirating surplus material.

51. Device according to claim 50, characterized in that said material introduction nozzle (48) is inclined.

52. Device according to either claim 50 or claim 51, characterized in that the distal end of said introduction nozzle (48) is below the distal end of said aspiration nozzle (49).

53. Device according to any of claims 50 to 52, characterized in that said plug (5) for plugging said filling hole (19) comprises a blind hole (51) and in that said plugging station (42) comprises a canula (50) adapted to be engaged in said blind hole (51) of said plug (5).

54. Device according to claim 53, characterized in that it comprises means for connecting said canula (50) to a vacuum system to hold said plug in place on said canula and for venting said canula (50) to the atmosphere to release said plug (5).

55. Device according to either claim 53 or claim 54, characterized in that it comprises means for driving said plugging station (42) to push said plug (5) into said filling hole (19).